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전기자동차 베터리 차단장치의 이론적 수명 예측에 대한 연구

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The Theoretical Life Prediction of Battery Disconnecting System for Electric Vehicle

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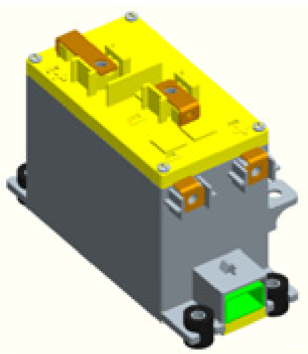
Abstract – Battery Disconnecting System (BDS) is the important equipment in electric vehicle system. Therefore, most of electric vehicle companies, i.e. Hyundai Motors, Renault Motors, General Motors, want to have the reliability of 15 years - 150, 000 miles. Recently, reliability prediction through Siemens Norm SN 29500 is considered without testing. In this paper, we will introduce the standard and various input parameters. Also the case study will be shown for BDS. Prediction model is constructed by listing all the components of BDS. It calculates the π factors for each components using the conversion equation in the standard and converts the reference failure rates to the expected operating failure rates. According to the result, the parts which will be improved are EV-Relays.

1. Introduction

Reliability prediction is a quantitative analysis technique used to predict the failure rate of a system based on the components of the system and its operating conditions. A reliability prediction is typically performed using an accepted, published standard, which defines failure rate equations for various components used in the system design. There equations were developed by using statistical techniques to analyze failure data gathered on actual operating equipment. The equations take into account the various parameters, such as part quality and operating stresses, which have an effect on component reliability. To begin a reliability prediction analysis, we must first define your system and all of its component parts. We then use the model equation to determine the failure rate of each particular component in your system. To get overall system failure rate, we add up all the component failure rates.



<Fig. 1> Battery Disconnecting System

Doing this analysis by hand can be tedious, time-consuming, and error prone. Using a software application such as RELEX Reliability Prediction to perform this work can dramatically increase the efficiency and accuracy in performing analysis. It can support for all current prediction standards, including MIL-HDBK-217, Telcordia, PRISM, 217Plus, HRD5, RDF2000, IEC TR 62380, NSWC Mechanical, Chinese 299, and Siemens SN 29500. [2,3]

To carry out these predictions failure rates for all the component parts are necessary. There are several well known reliability standards giving these failure rates. Probably the most widely used is MIL-HDBK-217 in US. In Europe the Siemens Norm SN 29500 standard is in common use for commercial equipment and this data has been chosen for the model.

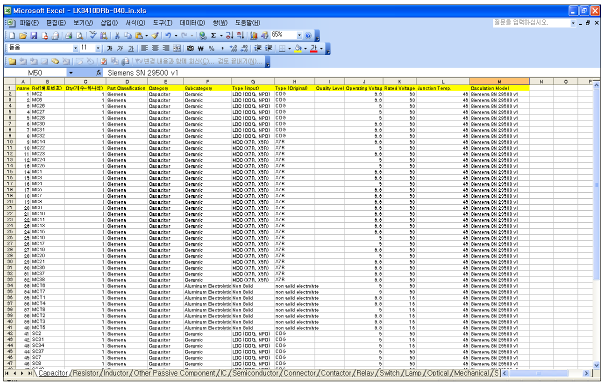
Predicting BDS reliability was conducted by old version of Siemens Norm SN 29500(1997) with MS Excel. Now we will show the method of reliability prediction by new version of Siemens Norm SN 29500 (2008) with RELEX Prediction toolbox. [1,4]

2. Case Study

The theoretical reliability prediction is conducted for BDS with RELEX Reliability Prediction toolbox. The sequence of analysis is bellow:

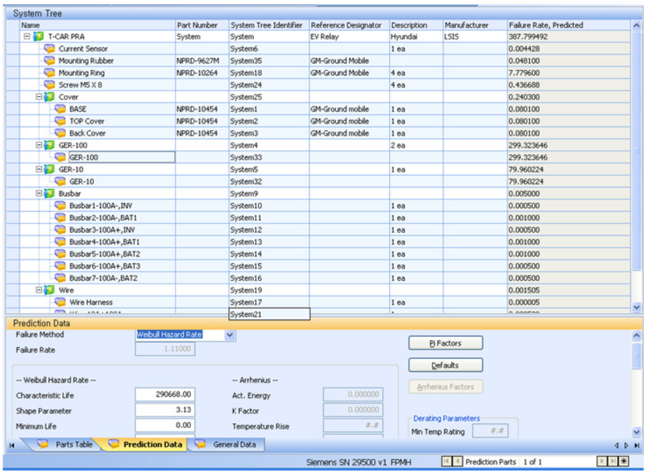
1. Make the part list with MS Excel.
2. Import the data to RELEX.
3. Calculate the reliability prediction
4. Report the reliability prediction summary

The part list is shown in Figure 2. Category, subcategory, type, operating voltage, rated voltage, and junction, temperature, have to be recorded in order to predict the reliability accurately.



<Fig. 2> Part list with Excel

All data can be imported to RELEX easily. The imported data is shown in Fig. 3. RELEX Architect consists of five parts - Project Navigator, System Tree, Parts Table, Prediction Data, General Data.



<Fig. 3> Imported data with RELEX

3. Conclusion

The theoretical reliability prediction is conducted for BDS. The input data consists of various data base-NPRD/EPRD, Experimental data with Siemens Norm SN 29500 prediction model. The reliability of EV-Relay should be improved in order to improve BDS according to this study. The development of accelerated life testing and reliability assessment will be conducted for qualifying the reliability of BDS.

[Reference]

[1] Evans, G, "Predicting Electronic Meter Reliability, Metering and Tariffs for Energy Supply, 1999. Ninth International Conference on (Conf. Publ. No. 462), 25-28 May 1999, pp. 156-159.

[2] RELEX Reliability Studio 2008 Getting Started Guide, RELEX Software Corporation, 2008.

[3] RELEX Reliability Studio Reference Manual, RELEX Software Corporation, 2008.

[4] Siemens Norm SN 29500-1, Siemens, 2008